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The Neutral Rate in Canada: 2018 Estimates

Xin Scott Chen and José Dorich

Canadian Economic Analysis Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
scottchen@bankofcanada.ca
jdorich@bankofcanada.ca

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Abstract

The neutral nominal policy rate serves as a benchmark for assessing the degree of monetary stimulus and provides a medium- to long-run anchor for the policy rate. Since quantitative measures of the neutral rate are subject to considerable uncertainty, Bank staff rely on four different approaches to estimate the Canadian neutral rate. These approaches take explicit account of domestic and global factors, the relative importance of which varies with each approach. Informed by this analysis, Ba[illegible]ff estimate that the Canadian neutral nominal policy rate lies between 2.5 and 3.5 per cent, the same range reported in the April 2017 *Monetary Policy Report*.

Bank topics: Economic models; Interest rates; Monetary policy
JEL codes: E40, E43, E50, E52, E58, F41

Résumé

Le taux directeur nominal neutre sert d'indice de référence pour évaluer le degré de détente monétaire dans l'économie et représente un point d'arrimage à moyen et à long terme pour le taux directeur. Comme une incertitude considérable entoure les mesures quantitatives du taux neutre, le personnel de la Banque recourt à quatre méthodes différentes pour estimer le taux neutre canadien, lesquelles tiennent compte explicitement de facteurs nationaux et mondiaux. L'importance relative de ces facteurs varie selon la méthode. À la lumière de la présente analyse, le personnel de la Banque situe le taux directeur nominal neutre du Canada entre 2,5 et 3,5 %, la même fourchette que celle indiquée dans la livraison d'avril 2017 du *Rapport sur la politique monétaire*.

Sujet(s) : Modèles économiques; Taux d'intérêt; Politique monétaire
Code(s) JEL : E40, E43, E50, E52, E58, F41

1 Introduction

Each year, Bank of Canada staff review their analysis of the neutral interest rate in conjunction with their annual reassessment of potential output. This note presents the key elements of the neutral rate analysis.

There are several accepted definitions of the neutral nominal policy rate. Bank staff define it as the real rate consistent with output holding at its potential level and inflation holding at target on an ongoing basis, plus 2 per cent for the inflation target. This is a medium- to long-run equilibrium concept that varies over time, depending on low-frequency structural factors, such as demographic change and variations in trend productivity growth.

Estimates of the neutral rate are subject to considerable uncertainty. Consequently, Bank staff estimate the neutral rate by using four distinct approaches first introduced in Mendes (2014). One of the most important dimensions in which the four approaches differ is the relative weights placed on domestic and global factors. Using these approaches, Bank staff estimate that the Canadian neutral nominal policy rate lies between 2.5 and 3.5 per cent, the same range reported in the April 2017 *Monetary Policy Report*.

The remainder of this note is organized as follows. Section 2 reports the range of estimates implied by the four approaches being used. Section 3 describes the approaches and the results in greater detail. Section 4 concludes.

2 Current estimates of the neutral rate

Table 1 reports the current estimates of the Canadian neutral nominal policy rate implied by the four approaches, namely: (i) a pure interest parity condition placing full weight on foreign factors; (ii) a neoclassical growth model placing full weight on domestic factors; (iii) a reduced-form model that combines domestic and foreign factors in a scaled-down, non-structural way; and (iv) a small open economy overlapping-generations model that captures both domestic and foreign factors in a structural way, with the former including demographic and life-cycle effects that the other models do not account for.

Table 1: Summary of neutral nominal policy rate estimates for Canada

Approach	2018 Estimates (%)	2017 Estimates (%)
Pure interest parity	2.5–3.5	2.5–3.5
Neoclassical growth model	3.5–3.75	3.25–3.5
Reduced-form model	2.5–3.25	2.5–3.0
Overlapping-generations model	2.75–3.25	3.0–3.5
All approaches	2.5 –3.75	2.5–3.5
Staff view	**2.5–3.5**	**2.5–3.5**

From the table, we see that these models together place the neutral nominal policy rate between 2.5 and 3.75 per cent. However, the upper bound of this range is associated with the neoclassical growth model, which suffers from several shortcomings that we elaborate on in our next section. For this reason, Bank staff view the 2.5 to 3.5 per cent interval as a more appropriate range.

3 The approaches and the results in greater detail

3.1 Pure interest parity

This approach assumes perfect international capital mobility. Since Canada is small relative to the rest of the world, this implies that the Canadian neutral rate should coincide with the global neutral rate and is thus determined entirely by foreign factors.

Following Mendes (2014) and Dorich, Reza and Sarker (2017), we interpret the US neutral rate as a proxy for the global neutral rate. Our midpoint estimate of the US neutral rate is the median projection of the longer-run target federal funds rate reported in the Federal Reserve's Summary of Economic Projections. As of the March 2018 release, this measure stood at 3.0 per cent after rounding to the nearest 25 basis points (bps). **Table 2** reports comparable estimates from other sources, all of which fall broadly in line with this midpoint estimate.

Given the uncertainty surrounding the US neutral rate, we place our midpoint estimate inside a 2.5 to 3.5 per cent range. This range contains the projections reported by 13 of the 14 Fed policy-makers surveyed in the Fed's Summary of Economic Projections.

Table 2: Estimates of the nominal interest rate in the United States over the medium to long run
Rounded to the nearest 25 basis points

	Estimate (%)	Date of estimate
Federal Reserve	3.0 (median)	March 2018
International Monetary Fund	3.0	July 2017
Macroeconomic Advisers	2.75	April 2018
TD Economics	2.75	March 2018
Congressional Budget Office	3.0	April 2018

3.2 Neoclassical growth model

This model is frequently used in discussions about the neutral rate. In this model, the economy is assumed to be closed, and households with an infinite lifespan demand a real interest rate that in the long run is approximately equal to

$$r = \rho - \gamma + \sigma g + n, \tag{1}$$

where r is the real risk-free rate; ρ is the rate of time preference; γ is a household credit spread; σ is the inverse elasticity of intertemporal substitution; g is the rate of per capita income growth; and n is the rate of

population growth. This equation provides some intuition about how economic growth influences real interest rates in the long run. In particular, the higher future income implied by an increase in growth leads forward-looking households to consume more and save less, all else equal, thus placing upward pressure on the real interest rate.

We specifically measure long-run per capita income growth using the Bank's current projection of the average rate at which per capita potential output is expected to grow over the period 2018–21. The average rate of population growth expected over the same period is taken from Agopsowicz et al. (2018). In addition, we use the procedure in Mendes (2014) to estimate $\rho - \gamma$ at roughly -0.2 while setting $\sigma = 1.14$ as in Dorich et al. (2013). Taken together, all these inputs place the real neutral rate around 1.75 per cent, implying a neutral nominal policy rate of 3.75 per cent.

This estimate implicitly assumes that the long-run value of the household credit spread coincides with its historical average. However, since the post-crisis average spread is about 20 bps higher than its pre-crisis counterpart,[1] there is a possibility that household credit spreads may settle at a long-run value somewhat higher than that associated with the baseline case. For this reason, we consider an alternative scenario in which the long-run value of the spread is 25 bps above its historical average. In this case, the nominal neutral rate would fall to 3.50 per cent.

This approach suffers from some important shortcomings. Apart from not taking into account foreign factors and the demographic and life-cycle effects mentioned above, the model implies an unrealistically strong relation between the real neutral rate and potential output growth. In particular, with $\rho - \gamma$ close to zero and σ close to one, equation (1) places the real rate close to the sum $g + n$, which should coincide with the rate of aggregate potential output growth in the long run. This essentially one-to-one relation is difficult to reconcile with evidence from Hamilton et al. (2015), which documents a considerably weaker linkage in the data.

3.3 Reduced-form model

The two previous approaches are somewhat extreme in that they place full weight on either foreign or domestic factors when estimating the Canadian neutral rate. The reduced-form approach is more balanced. It posits a linear reduced-form relation between the nominal Canadian neutral rate, r^n; the growth rate of potential output, g^{ypot}; and the nominal global neutral rate, r^{world}, which we proxy as in subsection 3.1. When estimated using the procedure described in Mendes (2014), this relation takes the form[2]

$$r^n = 0.24 + 0.30g^{ypot} + 0.68r^{world}. \quad (2)$$

The coefficients in this equation indicate that the model places relatively more weight on global factors, consistent with the highly open nature of the Canadian economy. Combining the estimate of potential output growth discussed in our previous subsection with our midpoint estimate of 3.0 per cent for the nominal global neutral rate then yields a nominal Canadian neutral rate of 2.75 per cent, again rounding to the nearest 25 bps.

Given the relatively large weight attached to global factors in equation (2), it is important to note from the Fed's Summary of Economic Projections that the distribution of projected values for the longer-run federal funds rate exhibits some skew to the downside. For this reason, we entertain an alternative scenario in which the US neutral rate takes the lower-bound value of 2.5 per cent. In this case, equation (2) places the Canadian neutral rate at 2.5 per cent as well.

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[1] In particular, the spread averages about 230 bps over the period 2010–17, compared with 210 bps from the series' earliest availability (1999–2006).

[2] The sample period used for this estimation is 1995Q1–2017Q4.

One caveat to this approach is that the coefficients in equation (2) are sensitive to the sample period used for estimation. For example, if we re-estimate the equation using a sample that ends before the onset of the global financial crisis, the Canadian neutral rate comes in at 3.25 per cent when we assume a value of 3.0 per cent for the US neutral rate, falling to 3.0 per cent if we instead assume a US neutral rate of 2.5 per cent. Overall, this analysis points to a Canadian nominal neutral rate in the 2.5 to 3.25 per cent range.

3.4 Overlapping-generations model

This approach imposes an overlapping-generations (OLG) structure on a small open economy in which the neutral rate is given by the sum of a global neutral rate and a country-specific risk premium. The latter is assumed to decrease with Canada's net foreign assets (NFA)—that is, the premium is assumed to fall when Canada is a greater creditor to the rest of the world. This allows both domestic and global factors to influence the Canadian neutral rate.

As explained in Mendes (2014), the model generates estimates for the Canadian neutral rate based on the global neutral rate and trends for Canadian factors such as productivity growth, demographics and credit-risk spreads. Two parameters play key roles in the analysis: the elasticity of the country-specific risk premium with respect to NFA and the steady-state Canadian price markup. The former is a critical determinant of the relative quantitative importance of foreign factors, while the latter captures monopolistic distortions that affect the neutral rate. In particular, the greater distortions associated with higher markups tend to reduce firms' output and investment, all else equal. This leads to a higher current account and NFA, thus placing downward pressure on the Canadian risk premium and neutral rate.

This approach has several advantages over the other three approaches. For example, compared with the neoclassical growth model, the OLG model delivers a weaker link between the neutral rate and potential output growth and instead allows for a host of other potentially important neutral-rate determinants. The structural nature of the OLG model also compares favourably with the relative opacity of the reduced-form model, allowing Bank staff to explore how structural changes in the economy affect the neutral rate.

A series of simulations point to a range of 2.75 to 3.25 per cent for the Canadian nominal neutral rate. This range is 25 basis points lower than in April 2017, largely due to an upward revision in the steady-state Canadian price markup, which has been set 10 percentage points higher, at 20 per cent. Bank staff consider this value more appropriate, as it falls better in line with microeconomic evidence on Canadian price markups.

4 Concluding remarks

On balance, our analysis points to a midpoint estimate of 3.0 per cent for the nominal neutral policy rate, the same value assumed for the base-case projection in the April 2018 *Monetary Policy Report*. Of course, considerable uncertainty surrounds this estimate. In particular, we view the 2.5 to 3.5 per cent interval as an appropriate range after taking into account the various strengths and weaknesses associated with the different approaches discussed above.

With regard to avenues for future work, we note that the approaches presented above do not account for the role that precautionary savings may play in neutral-rate determination, contrary to evidence recently provided by, for example, Pflueger, Siriwardane and Sunderam (2016). Bank staff therefore plan to expand the neutral-rate toolbox to incorporate a formal role for precautionary savings.

References

Agopsowicz, A., D. Brouillette, B. Gueye, J. McDonald-Guimond, J. Mollins and Y. Park. 2018. "Potential Output in Canada: 2018 Reassessment." Bank of Canada Staff Analytical Note No. 2018-10.

Dorich, J., M. K. Johnston, R. R. Mendes, S. Murchison and Y. Zhang. 2013. "ToTEM II: An Updated Version of the Bank of Canada's Quarterly Projection Model." Bank of Canada Technical Report No. 100.

Dorich, J., A. Reza, and S. Sarker. 2017. "An Update on the Neutral Rate of Interest." *Bank of Canada Review* (Autumn): 27–41.

Hamilton, J. D., E. S. Harris, J. Hatzius and K. D. West. 2015. "The Equilibrium Real Funds Rate: Past, Present, and Future." Hutchins Center Working Paper No. 2015-16.

Mendes, R. R. 2014. "The Neutral Rate of Interest in Canada." Bank of Canada Staff Discussion Paper No. 2014-5.

Pflueger, C., E. Siriwardane, and A. Sunderam. 2016. "Precautionary Savings in Stocks and Bonds." Harvard Business School Working Paper No. 17-040.